CPSC 1155 – Lab 7

Repetition Statements

Lab Introduction

This lab helps you practice with different forms of loops in pseudocode and C++.

Learning Objectives

At the end of this lab, you should be able to:

- trace a pseudocode/C++ program with loops
- write repetition statements in pseudocode and C++

Lab Readings

1. Chapter 5 – Loops
2. Pseudocode Lecture

Lab Instructions

Write your answers to the **Practice Questions** in a text editor (answer.txt).

For each **Problem Statement**, follow the steps below:

1. Read the problem statement and clarify the problem.
    a. Break the problem into smaller problems if needed.
2. Determine the IPO.
    a. Determine input, output, intermediate variables, constants, conditions, and **repetitions**.
    b. Declare the variables and constants (data type + meaningful names).
    c. Work out the problem by hand using typical input values. Determine the range of valid input values.
    d. Determine the process.
3. Write a pseudocode as required.
4. Write a C++ program (use the given filename) that implements the pseudocode.
    a. Add comments where needed. Make sure to use a comments header to reflect the intention of your program and name of the author (you) and the date the program was written.
    b. Test, debug, and execute the program using typical values.

Submit according to the instruction in the "Lab Submission" section.

Learning Objectives

The goal of this lab is to practice with different forms of loops in C++.

Practice Questions

1. [8] **Trace a Pseudocode**. There are four loops in the following pseudocode. Write a trace table for each of them to determine the execution of the loop. If there is an infinite loop, trace the table for at least 5 rounds and indicate it is infinite.

```
Set num to 0
WHILE (num is less than 10)
  Print num
  Set num to num + 2
```

```
Set num to 10
WHILE (num is greater than 0)
  Print num
  Set num to num + 2
```

```
Set num to 0
WHILE (num is less than 10)
  Print num
  Set num to num - 2
```

```
Set num to 11
WHILE (num is not zero)
  Print num
  Set num to num – 2
```

2. [6] **Trace a Program**. There are three loops in the following C++ program. Write a trace table for each of them to determine the execution of the loop.

```
string stars = "*****";
string stripes = "=====";
int i = 0;

while (i < 5)
{
   cout << stars.substr(0, i) << endl;
   i++;
}

i = 0;
while (i < 5)
{
   cout << stars.substr(0, i);
   cout << stripes.substr(i, 5 - i) << endl;
   i++;
}

i = 0;
while (i < 10)
{
   if (i % 2 == 0) { cout << stars << endl; }
   else { cout << stripes << endl; }
   i++;
}
```

3. [4] **Reorder a Program**. Rearrange the following lines of code to produce a program segment that displays both the maximum and the minimum of a sequence of inputs. Write and test your program in a code editor. Write the correct order of statements by writing the line numbers as your answer in in answer.txt.

Line#	Instruction
1	`while (cin >> input)`
2	`double largest = input;`
3	`cout << "Minimum: " << smallest << endl;`
4	`cout << "Maximum: " << largest << endl;`
5	`cin >> input;`
6	`double smallest = input;`
7	`if (input < largest) { largest = input; }`
8	`double input;`
9	`if (input < smallest) { smallest = input; }`
10	`}`
11	`{`

4. [5] **Problem Solving**. You are required to read twelve temperature values and display the number of month with the highest temperature. Please refer to the attached document (howToLoop.pdf), review the steps to write a loop and complete Step 7 in the document (C++ program). Write the required code in answer.txt.

5. [6] **Pseudocode**. Write a pseudocode that computes:
   a. The sum of all even numbers between 2 and 100 (inclusive).
   b. The sum of all powers of 2 between 2 and 100 (inclusive).
   c. The sum of all squares between 1 and 100 (inclusive). (1, 4, 9, 16, …)

   You may write them in one loop or separate loops in answer.txt.

Problem Statement

6. [5] (sum_integers.cpp) You are required to calculate the sum and average of a sequence of integers.

   The program asks the user to input the number of integers first (you don't need to validate the input). Write a loop that reads each integer and adds it to sum on each iteration. You also need to calculate the average after the loop. Display the results with 4 digits after the decimal point.

   Here is a sample run:

```
Enter the number of values: 3
Enter 3 integers: 25 56 38
The sum of integers is 119
The average of integers is 39.6667
```

Lab Submission

Submit a zip folder named as yourName_Lab7.zip to Brightspace. This folder should consist of a **text file** named answer.txt with your answers to Practice Questions and **C++ codes** in individual .cpp files for the Problem Statements. Please make sure that all your .cpp files compile and run properly before submission. Your file must run properly in order to receive full marks.

Marking Scheme

The marks are given in square brackets [ ] for each question.